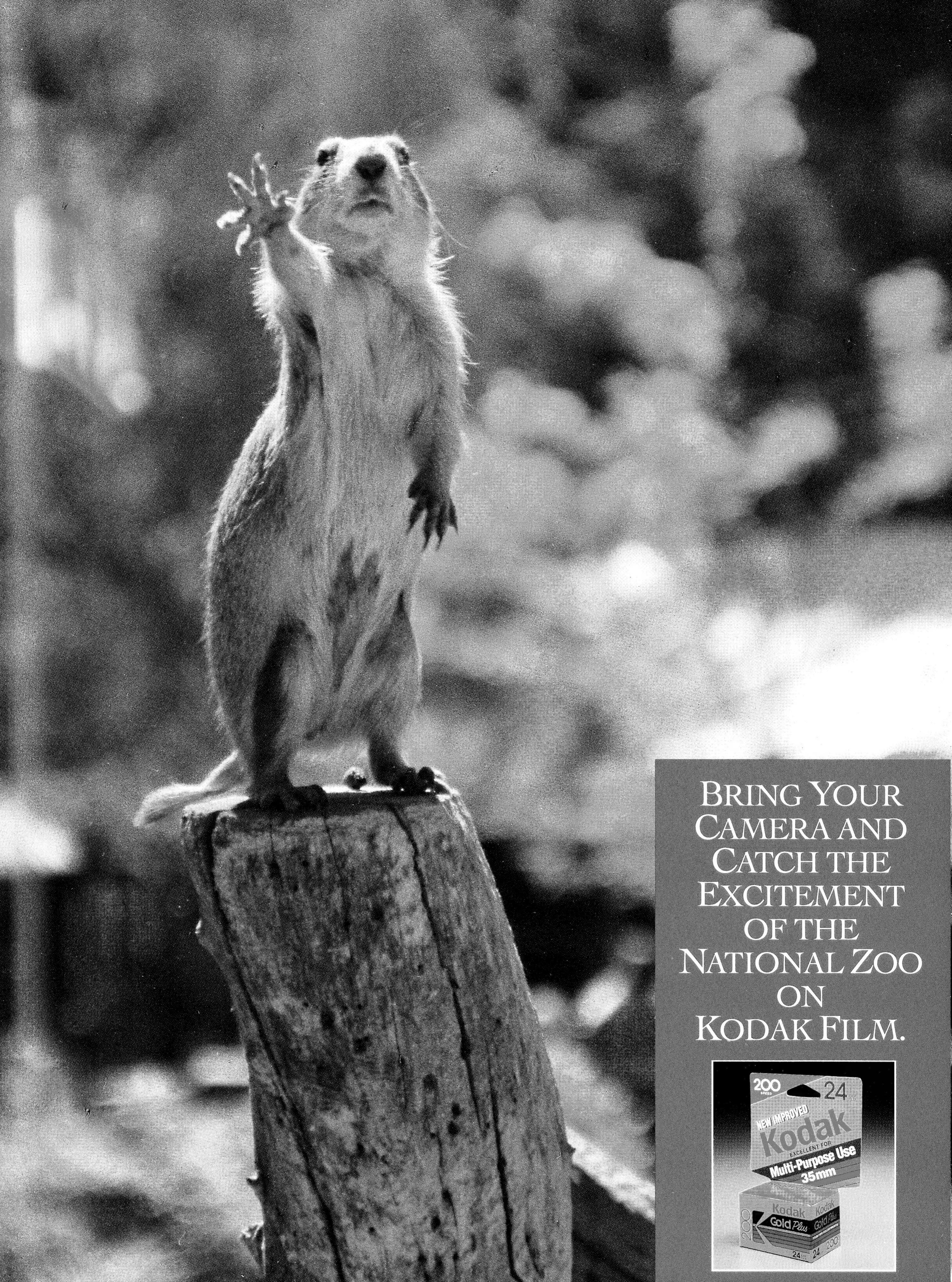


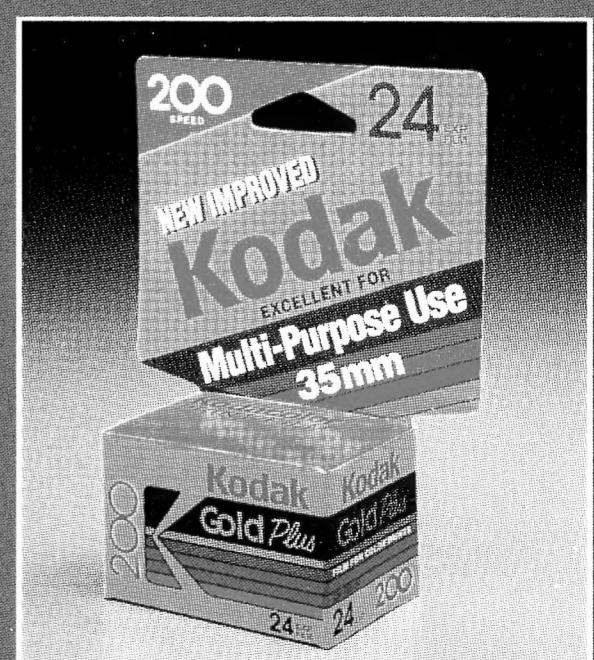
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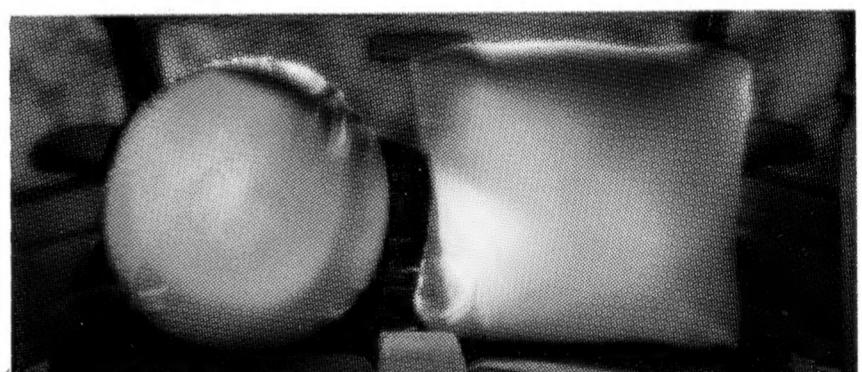


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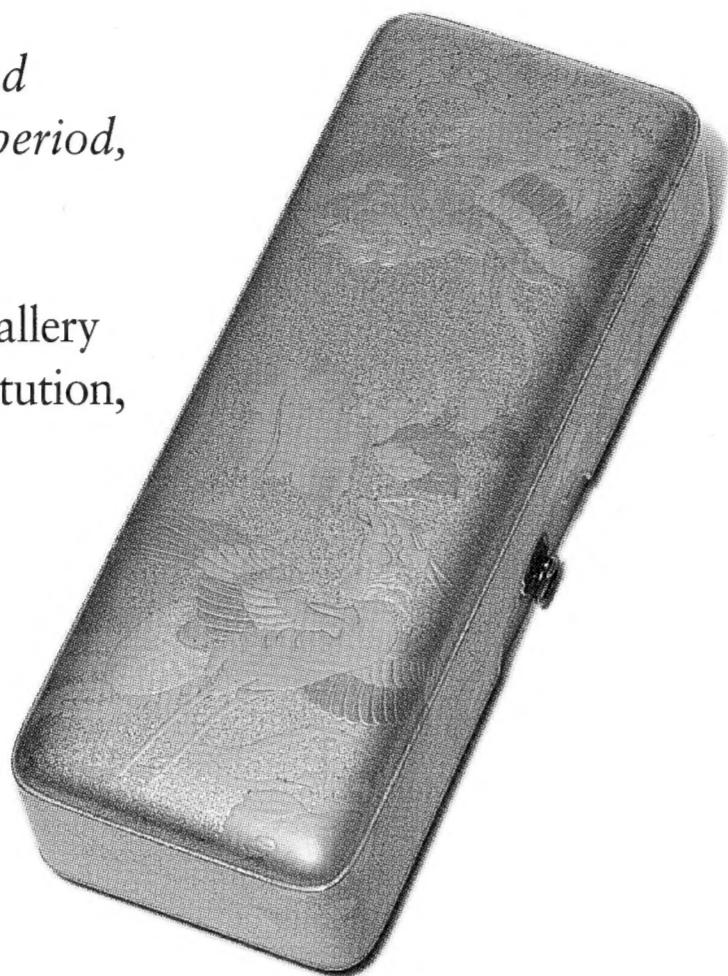
ZOOGOER

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44.23: *Lacquer on wood letter box. Japan, Edo period, 18th–19th century.*

Two phoenixes.

(Courtesy of the Freer Gallery of Art, Smithsonian Institution, Washington, D.C.)



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National**

is a nonprofit organization of individuals, families, and organizations who are interested in helping to maintain the status of the National Zoological Park as one of the world's great zoos, to foster its use for education, research, and recreation, to increase and improve its facilities and collections, and to advance the welfare of its animals.

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(Peter B. Clark)

Call for Nominations

In accordance with Article II, Section 7, of our By-laws, the FONZ Board of Directors is hereby soliciting nominations from the membership.

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The Board of Directors establishes the policies of the corporation, approves budgets and expenditures, and otherwise directs the activities of FONZ officers and employees. Members of the Board of Directors serve without pay.

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The **Education Committee** participates in development and oversight of FONZ-supported education and volunteer programs.

The **Membership Committee** participates in developing membership activities and policies and provides oversight for membership acquisition and retention programs.

The **Concessions Committee** oversees management and operation of FONZ gift shops, bookstore, food, and parking at the Zoo.

Other Board Committees include: Administration, Capital Planning, Development, Finance and Audit, Nominating, Visitor Services, ZooFari, and Publications Advisory Group.

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The criteria by which potential candidates are judged for nomination to the Board of Directors are: the candidate's strong interest in supporting zoological education, research, and conservation in accordance with the purposes of our corporation; leadership; experience or skills that are needed and that would directly benefit the management and operations of FONZ; and the willingness and time to participate fully in FONZ work and activities. Candidates must be dues-paying members of FONZ.

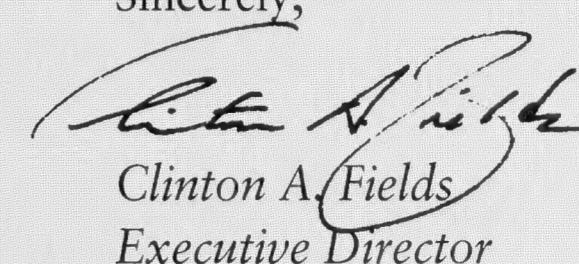
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Nominations must be submitted on an official FONZ Nomination Form with a biographical sketch of the nominee attached. Nomination forms can be obtained at the FONZ office or will be mailed upon request. For information or forms, call 202.673.4951. The deadline for submitting nomination forms and accompanying biographical sketches is June 14, 1993. Address submissions to:

William H. Berman, Chair, Nominating Committee, FONZ,
National Zoological Park, Washington, D.C. 20008.

Sincerely,



Clinton A. Fields
Executive Director

Farming On the Fly

Robin Meadows

Farmers in Papua New Guinea raise the smallest livestock in the world—butterflies. Prized for their striking coloration and huge wingspans, Papua New Guinea butterflies can yield as much income as coffee, palm oil, and other agricultural cash crops. But the real beauty of raising butterflies is that it gives people a way to earn money without clearing the tropical rainforest that covers most of the country.

Tucked between Australia and Indonesia, Papua New Guinea comprises the eastern half of New Guinea, the northern Solomon Islands, and hundreds of small coastal islands. People are believed to have

first settled what is now Papua New Guinea about 30,000 years ago.

Today, the people of Papua New Guinea speak more than 700 languages, most of which are mutually unintelligible. This remarkable linguistic diversity is due primarily to geography. On several of the larger islands, high mountain ranges—some peaks reach nearly 14,800 feet—fragment the land into many isolated valleys, and the people into highly isolated tribes that had little or no contact with each other for millenia. The rugged terrain also thwarted Western efforts to colonize the country. Thus, when Papua New Guinea achieved independence from

Australia in 1975, most of its natural resources were relatively intact—in stark contrast to the situation in many colonized lands.

Papua New Guinea's natural resources are considerable. In addition to the rainforest that covers 80 percent of its land, the country contains high-grade petroleum and some of the world's richest copper and gold deposits. But, while the resources are rich, the people are poor, and poor people in developing countries often have little choice but to overexploit their natural resources. In the process, these resources are often destroyed.

Papua New Guinea's exceptional biological diversity is due to the

same geographic isolation responsible for its linguistic and cultural diversity. Just as there are more than 700 languages, there are more than 700 species of butterflies in the country. These include nine species of birdwings—iridescent, predominantly green-against-black members of the swallowtail family named for their phenomenal size. Papua New Guinea's Queen Alexandra birdwing (*Ornithoptera alexandrae*) is the largest butterfly in the world: With an 11-inch wingspan, the tips of its wings would touch the top and bottom of this page.

At the beginning of this century, wealthy European patrons sent nat-

uralists on collecting expeditions to exotic parts of the world in hopes of adding such spectacular insects to their collections. In 1915, for instance, Lord Walter Rothschild sent one of the most famous collectors, A.S. Meek, to Papua New Guinea. Meek found the Queen Alexandra birdwing and many other butterflies new to Western science, and helped spark a collecting craze in Europe and the United States. Today's buyers include museums, scientists, and private collectors.

An Early Advocate of Breeding

Because butterflies are damaged when captured in nets, Meek advocated



A female common green birdwing, having just emerged from her pupal case. (Robert Michael Pyle)



Insect Farming and Trading Agency technician Kiperu Ipou with samples of butterfly species farmed in Papua New Guinea. (Robert Michael Pyle)

breeding butterflies. "Butterfly breeding...is quite necessary for the collector who wishes to obtain really good specimens," he wrote in his 1913 book, *A Naturalist in Cannibal Land*. "The advantage of breeding as compared with catching butterflies is, first, that you secure perfect specimens and, second, that you have a chance of securing now and again a 'sport.'" Sports are specimens with unusual markings and are highly valued; one collector paid \$500 for a birdwing sport.

Meek's advice was largely unheeded in Papua New Guinea until the insect trade grew to the point that the government declared seven of the birdwing species endangered in the 1966 Fauna Protection Ordinance. With the exception of the Queen Alexandra birdwing, which is unique to Papua New Guinea, these butterflies were probably not really endangered. "Most of

these butterflies are rare insomuch that they are not easily seen. However, they are reasonably well spread and can be locally common," says Peter Clark, who heads Papua New Guinea's Insect Farming and Trading Agency. "Mostly they were protected because expatriate dealers were exploiting both the birdwings and the people."

To reduce this exploitation, the Papua New Guinea Division of Wildlife established the Insect Farming, Trading and Conservation Project in 1974. The idea of farming insects was arrived at independently by Clark, who was then a government agricultural officer, and tea planter Angus Hutton. Clark and Hutton began to teach villagers how to breed and raise butterflies as well as how to market their novel crop. But Clark and Hutton soon found that realizing the full potential of the scheme

would require greater support from the government. "Major problems with payment, variety of species, and quality quickly became apparent," wrote Clark in a 1989 paper on insect farming.

To solve these problems, Hutton and Clark asked the Division of Wildlife to establish an agency that would provide a link between insect farmers and overseas buyers. "The Division of Wildlife...was very much behind the project," says Clark. Instituted in 1978 and managed since then by Clark, the Insect Farming and Trading Agency (IFTA) buys directly from the insect farmers to ensure that they are paid fairly and promptly. The IFTA then checks the quality of the insects so buyers know that no torn wings, missing legs, or other damage will mar the specimens they purchase.

Today there are more than 500 insect farmers in Papua New Guinea, most of whom raise butterflies. The farmers breed about 10 species of butterflies, including five species of birdwings. In addition, says Clark, "some people 'look after' stick and leaf insects and the huge *Coscinocera hercules* moth," which has a wingspan of 10 inches and a long, elegant tail. "That is, they keep them while they are growing, but this is raising—not breeding."

Understanding the Crop

Farming butterflies requires understanding their complex life cycle and needs at each stage of development. While adult butterflies generally drink nectar from a wide variety of flowers, most types of butterfly caterpillars eat only certain plants—sometimes just one species, but more often a family of plants. Thus, farming new species requires determining what the caterpillars eat.

Birdwing caterpillars eat various species

*J*ust as there are more than 700 languages, there are more than 700 species of butterflies in the country. These include nine species of birdwings—iridescent, predominantly green-against-black members of the swallowtail family named for their phenomenal size. The Queen Alexandra birdwing is the largest butterfly in the world: With an 11-inch wingspan, the tips of its wings would touch the top and bottom of this page.

of *Aristolochia*, vines with abundant heart-shaped leaves that can be trained to grow up trees or sticks. Two birdwings—the green, yellow, and black *Ornithoptera chimaera* and *Ornithoptera goliath*—depend on slow-growing *Aristolochia* species that live in mature forests and are hard to propagate; determining the culture requirements of these vines is a prerequisite of farming these butterflies. In contrast, caterpillars of the two most commonly farmed birdwings, the iridescent, green-and-black *Ornithoptera priamus* and the bright-gold-and-black *Troides oblongomaculatus*, eat a fast-growing *Aristolochia* species that is relatively widespread and easy to propagate from cuttings.

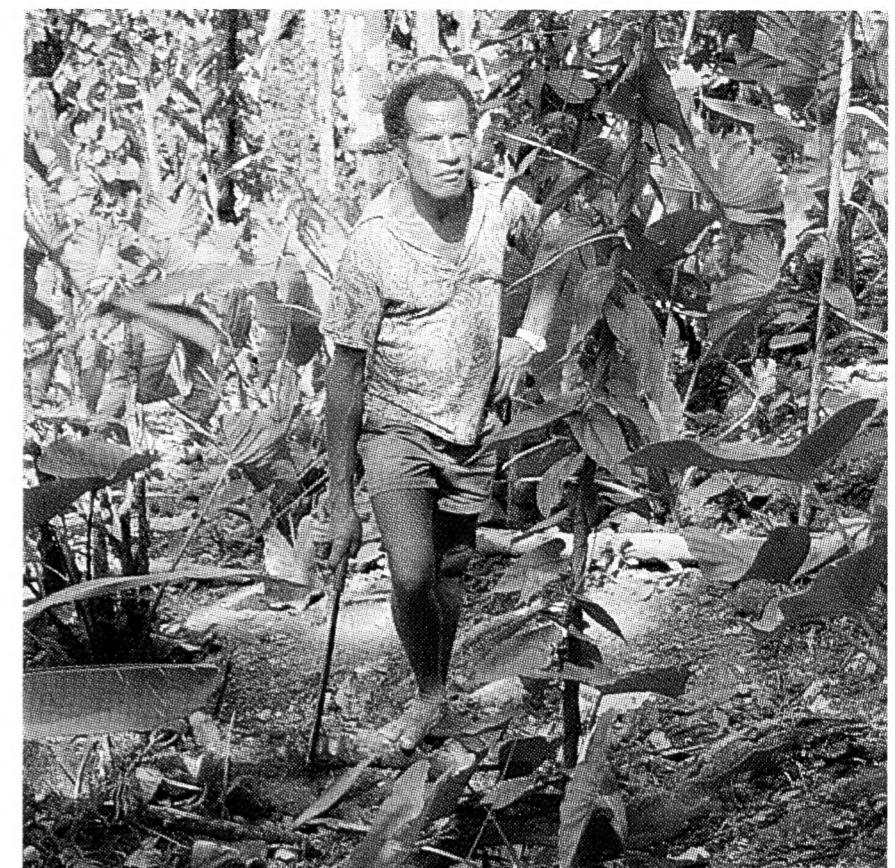
To raise birdwings, a butterfly farmer plants nectar-bearing flowers such as hibiscus and poinsettia to attract free-flying females that lay their eggs on the farmer's patch of *Aristolochia*. (Because the breeding adults fly free and only the offspring are taken into captivity, butterfly farming is, strictly speaking, ranching.)

The eggs are typically laid on the undersides of leaves and hatch eight to ten days

later. The newly hatched caterpillars immediately start eating, beginning with their eggshells and then progressing to the vine's tender new leaves and shoots.

The caterpillars grow rapidly, but their skin does not grow at all. When the skin gets too tight, it splits lengthwise down the back and the caterpillar crawls out. After molting, the caterpillar stretches to expand its soft new skin and then lies still for several hours to let it harden. The caterpillar molts five times during its four-plus weeks of growth, and is thumb-length after the final molt.

Butterfly farmers tend their crops of caterpillars carefully, removing diseased ones and protecting the rest from parasitic flies that lay their eggs on butterfly eggs and young caterpillars. Predators rarely threaten birdwing crops because *Aristolochia* vines contain an acid that makes the caterpillars eating their leaves distasteful. Of the 100 to 150 eggs laid by a single female, as many as 60 may survive to adulthood. The survival rate of farmed butterflies is higher than that of wild butterflies because the farmed animals are always guaranteed access to food plants.



Pioneer farmer Blu Rairi in the garden patch where he raises vines for birdwing butterflies. (Robert Michael Pyle)

A birdwing caterpillar begins the process of transforming itself into a butterfly after its fifth molt. Using silk from the spinneret below its mouth, the caterpillar attaches itself to a leaf or stem. Two days later, the caterpillar's skin splits and exposes the yellow-orange chrysalis, or pupal case. The pupal case soon hardens to protect the developing butterfly during the two- to



Female common green birdwing visiting a hibiscus flower in a butterfly garden. (Robert Michael Pyle)

Grow Your Own Butterfly Garden

Butterflies favor sunny, wind-sheltered gardens with plenty of nectar-rich flowers as well as food plants for caterpillars. The ideal butterfly garden also has some damp areas and some rocks in the sun where butterflies can warm themselves. Because most butterflies are active between 11 a.m. and 3 p.m., gardeners should plant flowers in areas that are sunny during these times.

Butterflies like flowers with a distinct scent and thus generally prefer old-fashioned blossoms to hybrids, which often have had the scent bred out of them. (Another problem with hybrids is that many have also had nectar production bred out of them.) While butterflies like yellow and red flowers, they are attracted to any bright color in the sun. Flower shape is more important than color—tubular and upright flowers allow butterflies to perch and sip comfortably.

Particularly good butterfly-attracting plants for the Washington, D.C., area include butterfly bush (*Buddleia davidii*), a long-blooming shrub with fragrant flowers that range in color from white to lavender to pink; bee balm

(*Monarda didyma*), a native herb with scarlet flowers; and *Lythrum salicaria*, a perennial with showy magenta flowers.

Caterpillars of many butterfly species require weedy, invasive plants that are shunned by most gardeners. For example, caterpillars of the orange-and-black monarch butterfly (*Danaus plexippus*) eat only milkweed. However, caterpillars of other species thrive on plants that most gardeners would be happy to grow in their gardens. Caterpillars of the yellow-and-black tiger swallowtail (*Papilio glaucus*) eat wild cherry (*Prunus*), willow (*Salix*), and tulip trees (*Liriodendron tulipifera*), and caterpillars of the orange, black, and white American painted lady (*Vanessa virginiensis*) eat various types of everlasting including *Gnaphalium* and *Anaphalis*.

Gardeners who use pesticides should be aware that these kill butterflies, too. If pesticide use is unavoidable, direct it carefully to minimize the spread of toxicants. In addition, organic gardeners should remember that *Bacillus thuringiensis* is deadly to caterpillars as well as pests.

—Robin Meadows

For more information on butterfly gardening, contact:

The Lepidopterists' Society
257 Common St.
Dedham, MA 02026
(617) 326-2634.

The National Wildlife Federation
(sponsors of the Backyard
Wildlife Habitat program)
1400 Sixteenth St., NW
Washington, DC 20036
(202) 797-6800.

The Xerces Society
(dedicated to invertebrate conservation)
10 S.W. Ash St.
Portland, OR 97204
(503) 222-2788.

Books on butterfly gardening include:
Butterfly Gardening
1990, Xerces Society/Smithsonian Institution,
Sierra Club Books.
How to Attract Hummingbirds and Butterflies
1991, Ortho Books.

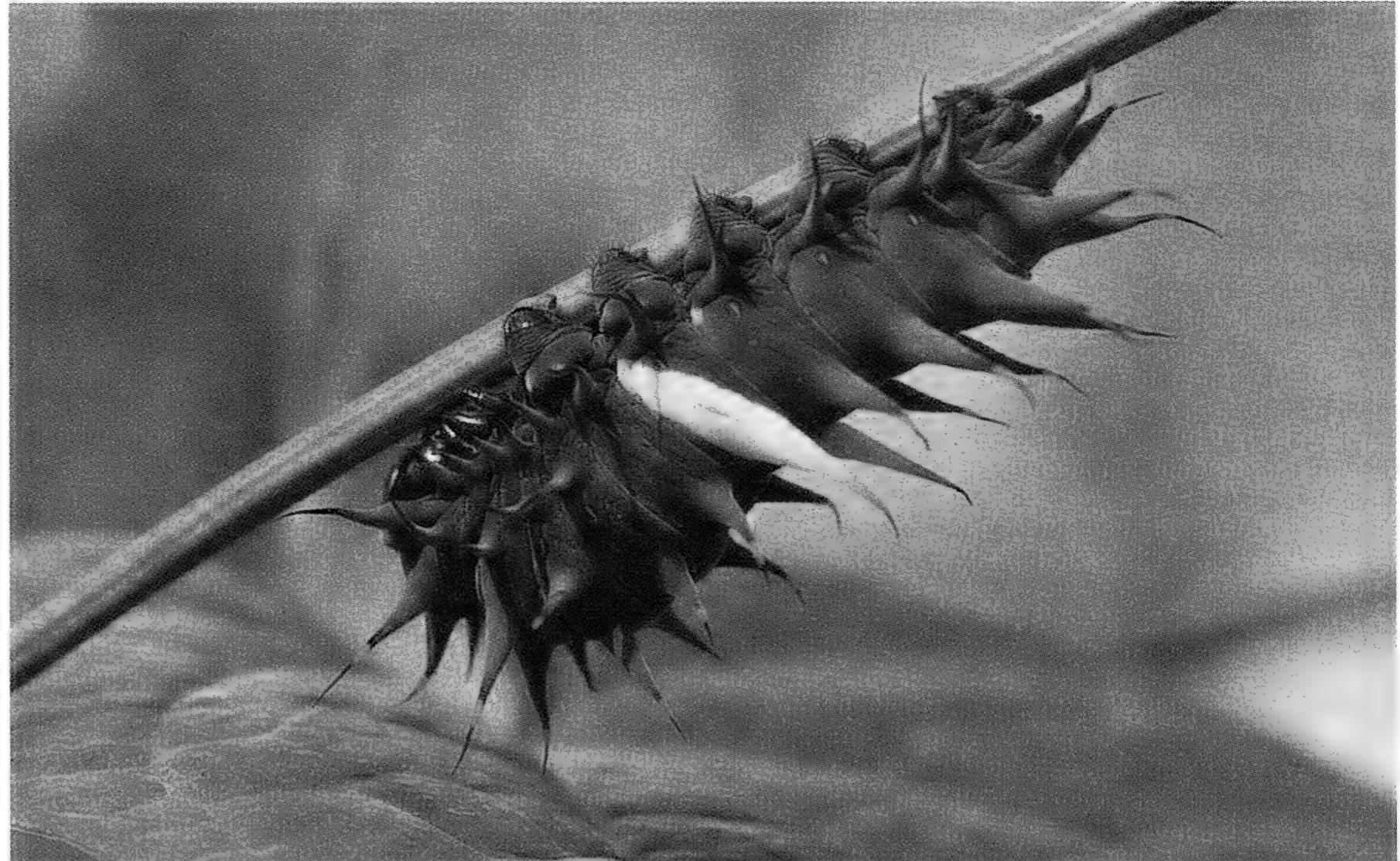
three-week pupal stage when larval structures are broken down and adult structures form; only the internal organs remain basically the same during metamorphosis.

From Harvest to Market

Once the pupal cases have hardened, the butterfly farmer puts most of them in a wire-enclosed emergence cage. The farmer cuts the pupa-bearing stems or leaves off the vines and pins them to a board inside the cage. But the farmer also leaves some of the pupae on the vines to replenish the breeding stock. Some farmers also harvest pupae and send them to the IFTA, which distributes them to insectariums that display living butterflies. However, the bulk of the Papua New Guinea trade is in preserved, adult butterflies.

A farmer can often tell when a butterfly is about to emerge, because on the preceding day the wing and body colors develop, making the pupa look darker. The emerging butterfly swells its thorax (the part of the body where the wings attach) to crack the case, allowing the head and thorax to emerge. Next, the butterfly pushes its legs out and uses them to pull its yellow abdomen and damp, crumpled wings free of the pupal case.

To extend its wings, the butterfly pumps a bloodlike fluid called haemolymph through the veins of the wings. Haemolymph contains chitin, which hardens the veins to make the wings rigid. This



Common green birdwing caterpillar on *Aristolochia* vine. (Peter B. Clark)

hardening process takes several hours. To allow as much time as possible to harden their wings, to warm up in the sun, and to find some nectar before dark, butterflies emerge early in the morning, usually between 7 and 9 a.m.

When their wings are completely hardened, the butterflies are harvested. The farmer kills the butterfly by injecting a small amount of alcohol or acetone into its thorax. Making sure not to dislodge the tiny scales that give the wings their beautiful colors, the farmer then carefully folds the wings, puts the butterfly in a pa-

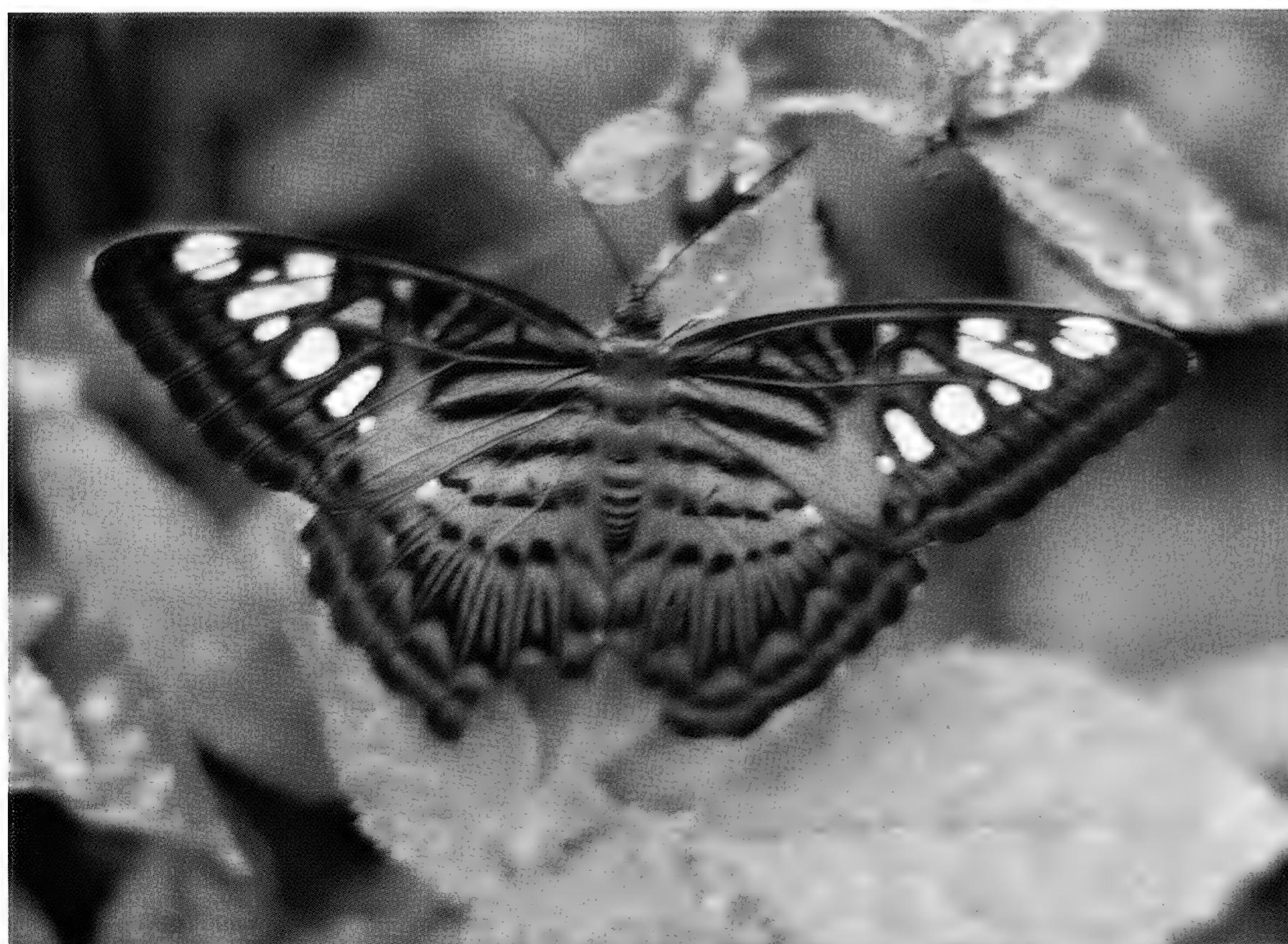
per envelope, and lets it dry on a black tray in the sun for several days. Finally, the farmer mails the dried butterflies to the IFTA.

Typical prices for birdwing butterflies range from \$2 to \$60, and butterfly farmers can make \$2,000 a year on a half acre of land, which exceeds the income a coffee farmer can make on a plot that size. Farmed butterflies account for roughly half of the million insects that the IFTA exports each year, and the insect trade brings Papua New Guinea about \$500,000 annually.

Worldwide, however, the butterfly trade may reach \$100 million per year. A few other countries, including Madagascar, Indonesia, and the Philippines, farm butterflies, but these operations are on a much smaller scale than those in Papua New Guinea. Most of the millions of butterflies sold are wild-caught specimens from Taiwan, Korea, Hong Kong, and Malaysia. These often poor-quality butterflies are used to decorate clocks, plastic toilet seats, and other consumer goods.

The already considerable demand for butterflies and other insects is growing at an estimated five to ten percent a year. By following Papua New Guinea's lead, other countries with spectacular insects might find that conservation can pay. And, that's a message that cannot be heard too soon in tropical countries that view logging, mining, and otherwise depleting their resources as their only hope for survival. ♣

Robin Meadows is a contributing editor to *ZooGoer*.



Raising *Papilio weymeri*, an uncommon species, allows paramedic David Pohai to stay in his village rather than seeking work in the city. (Robert Michael Pyle)

Watching Out for GRAY WHALES



In the 1800s, gray whales were considered the most dangerous of whales. Whalers called them "devilfish" for their habit of crashing headfirst into boats when harpooned. Today, however, gray whales swim alongside boats and allow passengers to stroke them. Biologists now call them "friendly" whales.

The dramatic shift in the gray whale's behavior around man reflects the dramatic shift in man's behavior toward whales: No longer considered a resource to exploit, whales

have been protected by international law for nearly 50 years. The California gray whale population has flourished under this protection, increasing from an estimated 1,500 in the early 1900s to about 21,000 today, a level that may exceed pre-exploitation numbers. This recovery led the National Marine Fisheries Service (NMFS) to remove the California gray whale from the endangered species list this January. The only other U.S. species to have been delisted is the American alligator.

Story by Robin Meadows • Photos by Steven L. Swartz, National Marine Fisheries Service

Gray whales (*Eschrichtius robustus*) are among the smaller of the baleen whales, reaching up to 45 feet long and 30 tons. They may live as long as 70 to 80 years.

As many as 180 yellowish baleen plates line a gray whale's upper jaw. Commonly called "whalebone," these horny plates are actually made of the skin protein keratin, as are fingernails and hooves. Each plate is frayed at the ends into bristles that can trap small organisms. Gray whale baleen is short and coarse—at only 16 inches long and nearly a fifth of an inch thick, it was unsuitable for making the corsets, Venetian blinds, and other "whalebone" products that were popular at the turn of the last century.

Angular and primitive-looking, the gray whale has large paddle-shaped pectoral fins and a series of small bumps extending along the ridge of its tail. The head and back of this baleen whale are typically festooned with yellowish-white blotches of barnacles and whale lice that provide a striking contrast to the mottled gray skin for which the whales were named.

The inch-and-a-half barnacles, deeply embedded in the whale's skin, are members of a species (*Cryptolepas rhachianecti*) found only on gray whales. The inch-long "lice" (they are actually crustaceans, not insects) infest barnacle clusters and cling to the folds of



skin around the whale's eyes and throat grooves. Whale lice eat dead and sloughing skin and swarm to wounds, which may benefit the whales by speeding the healing process.

Gray whales once lived in near-shore waters of both the North Atlantic and the North Pacific, but today they are found only in the latter ocean.

Two geographically isolated stocks of gray whales live along the Pacific Rim: the Californian and the Korean. The gray whales' dependence on coastal waters made them particularly vulnerable to shore-based whaling and, like the California stock, the Korean stock was severely depleted by the early 1900s.

However, the Korean stock has not recovered. "There are so few Korean gray whales that we don't know how they're doing," says Steven Swartz, a senior scientist at the National Marine Fisheries

Service. "There have not been enough reliable sightings to develop a population estimate." Accordingly, the NMFS has recommended that the Korean stock remain on the endangered species list.

California gray whales typically summer in the northern Bering and southern Chukchi Seas, Arctic waters between Alaska and Siberia that provide plentiful amounts of food. While the 10 other species of baleen whales eat plankton near the surface of the ocean, gray whales prefer



Research camp on inner shores of Laguna San Ignacio.

bottom-dwelling organisms. Gray whales eat a variety of prey including mysid shrimp, crab larvae, and bivalve mollusks, but their primary prey are amphipods, small (less than a half-inch long) crustaceans that live just beneath the sand. "Imagine a carpet of tubes covered with sand," says Swartz. "Amphipods build a colony similar to a beehive."

The whales dive to the bottom and suck up organisms, sediment, and water, leaving characteristic shallow depressions in the sand. Most gray whales are right-sided feeders as evidenced by the worn baleen on the right side of their mouths. After sucking up a mouthful, the whales strain the water and sediment through their baleen and swallow the remaining organisms.

The Long Haul

Gray whales feed heavily in the Arctic seas from May through October in preparation for fasting during most of the rest of the year, when they migrate to and from their winter breeding grounds along the coast of Southern California and Baja California, Mexico. This "feast or famine" pattern is also characteristic of blue whales, humpbacks, and other great whales that migrate seasonally.

Gray whales often feed and migrate in pairs or small groups called pods. Pods of whales stay together and follow the same breathing rhythm, surfacing either together or just slightly out of phase. Gray whales have also been observed helping each other. For example, Swartz and his colleagues saw female whales working together to free a calf stranded on a sandbar. The combination of their social behavior and their habit of staying within a few miles of shore makes gray whales favorites of West Coast whale-watchers.

The whales begin their migration south in November. "The northern seas go from almost total daylight to almost total night. The waters get covered with ice and are stormy, so the whales leave," says Swartz. "They stop occasionally, but basically move at the same speed of about four miles per hour day and night." This is particularly impressive considering that gray whales migrate farther than any other mammal—roughly 6,000 miles each way.

Their southward migration is not all work, though, because the whales also begin to mate on their way down to Mexico. Gestation takes 13 months, which means that newly pregnant females do not give birth until they have completed the following year's southward migration.

When the gray whales reach their destination, females that are ready to give birth assemble in the shallow, nearly landlocked lagoons and bays of Baja California. Calves are born between early January and mid-February, and the mothers and babies stay together well into the summer. The other gray whales typically winter just outside the sheltered lagoons and bays, spending their time mating and resting.

Gray whales migrate back north in two waves. The first wave comprises males and newly pregnant females that leave in February and March, reaching their Arctic feeding grounds in May. The second wave comprises females with newborn calves. "The females move more slowly with calves in tow, so this wave is more protracted. Some are still leaving at the end of May," says Swartz.

To the Brink of Extinction

Cow-calf pairs were particularly vulnerable to whalers. Lured to California by the gold rush of the 1840s, many New Englanders stayed to hunt whales. Because California whaling was seasonal, the

B

y selectively killing cows and calves, the whalers greatly decreased the population's ability to sustain itself. So few gray whales remained in 1875—a mere 20 years after gray whaling began in earnest—that few whalers bothered to pursue them.

men could have the excitement of the hunt as well as the comfort of farms and families. This lifestyle was also attractive to immigrants from the Azores and Cape Verde, Portuguese islands where people both farmed and fished. The whalers launched perilously small boats (31 by 6 feet) from the shore and typically used hand harpoons to hunt gray whales and humpbacks, another coastal species.

Whalers soon followed gray whales to the Baja California lagoons and bays and concentrated their kill on the cows and newborn calves crowded there with few routes of escape. By selectively killing cows and calves, the whalers greatly decreased the population's ability to sustain itself. So few gray whales remained in 1875—a mere 20 years after gray whaling began in earnest—that few whalers bothered to pursue them.

In the early 1900s, shore-based whaling in California was replaced by modern whaling, which involved shooting whales with explosive-tipped harpoons from cannons mounted on oceangoing vessels. While modern whalers sought other, more abundant species, they nevertheless killed any gray whales they encountered, further depleting the population.

International protection of the California gray whale was not ensured until 1946, when both the United States and the Soviet Union signed an International Whaling Commission agreement that forbade killing gray whales. The agreement included a proviso that Siberian natives whose culture and economy depend on gray whales could continue to take about 165 per year.

But, by 1970 the gray whale population had grown only to an estimated 7,000, leading the United States to list the species as endan-



A researcher observes as a group of courting gray whales passes under her skiff.

gered. Because seven of the eight other species of great whales found in North American waters were also in trouble (Bryde's whale was the eighth species), they too were listed as endangered the same year.

The California gray whale is the only great whale that has recovered. The population is growing steadily at about three-and-a-half percent a year and there are indications that it may be near carrying capacity (the number that the habitat can support under optimal



An inquisitive one-month-old gray whale calf takes a peek at a boatload of researchers.



Oceangoing salt barges on Scammon's Lagoon, bound for Cedros Island.

conditions). Gray whales are being sighted in parts of their historic range that they had abandoned when their numbers were low, and their pregnancy rate may be declining slightly.

While protection from hunting is the main reason for the gray whale's recovery, there is clearly more to it than that. "Other species of great whales, such as blue whales and humpbacks, have had the same protection but have not recovered," says Swartz. "The question is, 'What is different about the gray whale?' I think that gray whales are unique in a number of ways. Their entire life history takes place on the continental shelf, which is very productive. Gray whales are benthic [bottom] feeders and so have reliable, predictable prey sources. And they have the flexibility to use more than one type of prey. Other types of baleen whales also migrate to feed, but their prey is patchy—blue whales eat mostly krill, which are small pelagic [open oceangoing] crustaceans."

Delisting will probably have little impact on the gray whale. "There are threats to their habitat—development for oil and minerals, and boat traffic," says Swartz. "But, if those are the only reasons for listing them, we should list everything that lives on the coast, including marine birds. Even when delisted, they'll still be

protected under the U.S. Marine Mammal Protection Act, so it's not like we're abandoning them. Delisting requires NMFS to monitor the population for five years to make sure we haven't made a dramatic error. A census is under way now." Besides being protected in U.S. waters, gray whales are protected in their Arctic feeding grounds by Russia and the United States, and in their Baja California calving grounds by Mexican law.

"Friendly" Whales and Throng of People

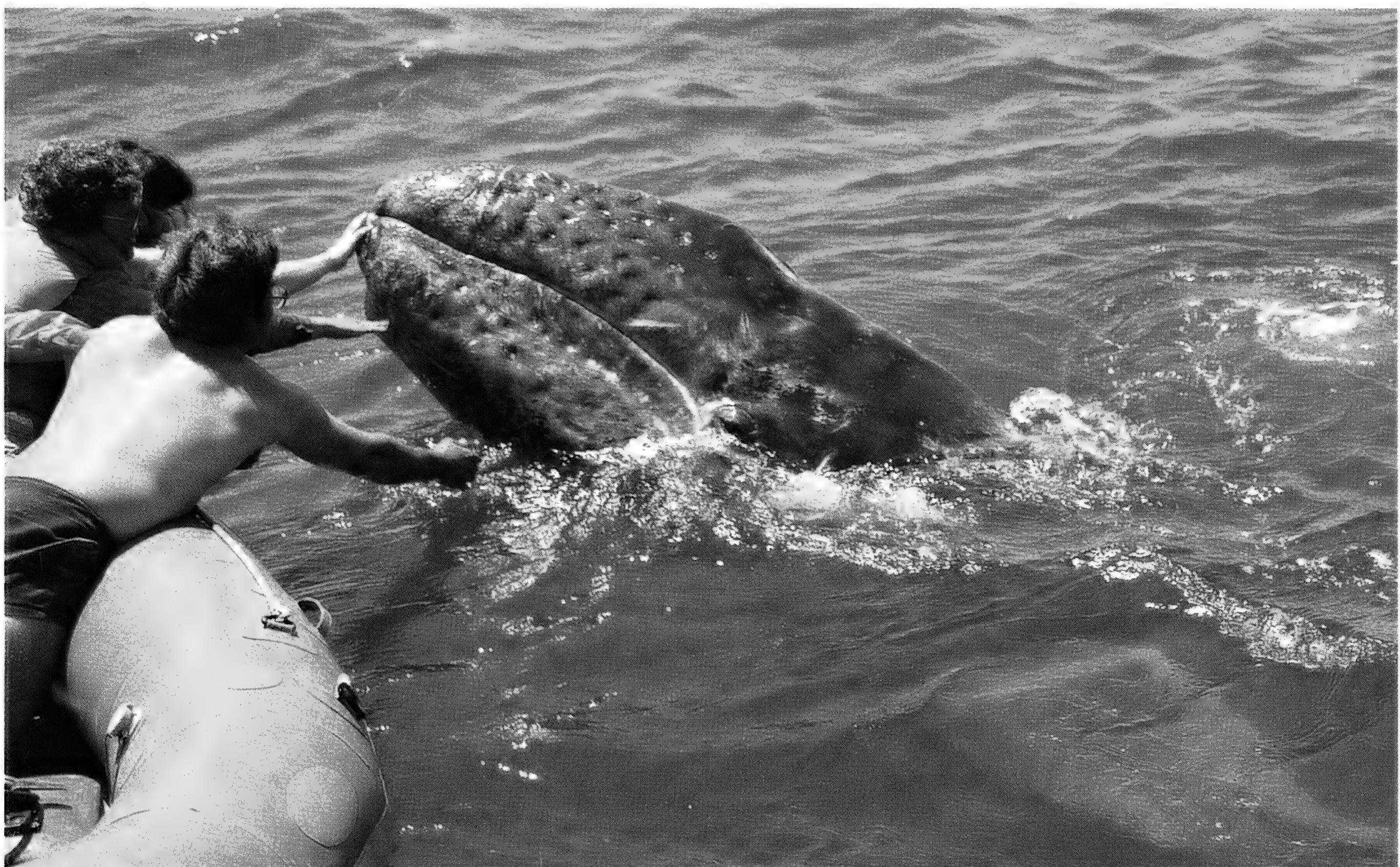
Although the gray whale is no longer in danger of extinction, the NMFS cautions that potential threats to the species remain. The near-shore waters where gray whales migrate, mate, and calve are increasingly being used by people, and development of their habitat can drive gray whales away. For example, between 1957 and 1967, gray whales deserted Laguna Guerrero Negro, the most northern and easily accessible of their calving grounds, when the area was disturbed by commercial shipping and associated dredging. When these disturbances ceased, the whales returned.

Likewise, gray whales flee the seismic exploration and drilling noises associated with oil and gas development, which has been proposed for much of the species' range. Biologists speculate that because the frequencies of gray whale calls overlap with those of industrial noises, they disrupt the whales' communication. Once considered to be silent, gray whales are now known to make low-frequency sounds that range from rumbles to croaklike grunts. However, there are not yet enough data to interpret their sounds.

Another potential threat to gray whales is the increasing boat traffic along their migration route as well as in their feeding and calving grounds. "All of the lagoons have some degree of local fishing and Scammon's Lagoon [the largest calving lagoon] has the world's largest evaporative salt operation, which means lots of barge traffic. But that's just in one part of the lagoon and gray whales simply avoid it," says Swartz.

In addition to coexisting with industrial and fishing boats, gray whales share their habitat with boats that come for the express purpose of bringing people to see them. In the 1970s, an increase in commercial whale-watching boats in the calving lagoons led Mexico to establish refuges in three of the most-used wintering lagoons:

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An encounter with a "friendly" whale in Laguna San Ignacio. Scientists are monitoring the effects of increased whale-watching on the behavior of gray whales and other whales.

Laguna Guerrero Negro, Laguna Ojo de Liebre (Scammon's Lagoon), and Laguna San Ignacio. The number of vessels in the lagoons is regulated by permit, and entry into nursery areas is forbidden. "Two-thirds of San Ignacio Lagoon is off limits during the breeding season," says Swartz.

The rise in commercial whale-watching has raised questions about the activity. "I think whale-watching is a good thing as long as it's done responsibly," says Swartz. "You can love something to

death, whether it's Yosemite or gray whales, if there are so many people watching that they interfere with essential behaviors. But, whale-watching is a real opportunity for people to gain an appreciation of wildlife that they can't get another way."

While gray whales in calving lagoons show little obvious response to slow-moving boats, the long-term effects of their movement and noise are unknown. To be on the safe side, the NMFS wants boats to stay at least 100 yards away from the whales. "This physical buffer would allow the whales to make the choice of whether to stay or go," says Swartz.

More often than not, it seems, gray whales choose to stay. Apparently attracted by the engine noises of small, idling boats, so-called friendly or curious whales readily allow people to touch them. Some gray whales become friendlier with successive encounters and have remained with boats for as long as two-and-a-half hours.

Perhaps the most remarkable aspect of this behavior is that mothers allow their calves to participate. "Friendly mother gray whales seemingly do not perceive the interaction between the boats and their calves as a threatening situation," wrote Swartz and Mary Lou Jones in their 1984 book *The Gray Whale*. Some biologists attribute this lack of fear to the fact that most of the gray whales alive today are too young to have been harassed by whalers.

The first friendly gray whales reported were encountered in San Ignacio Lagoon during the mid-1970s, and since then people have encountered them all over the gray whale's range. By protecting the gray whale, we have saved a species and serendipitously widened the range of human experience. ♦

Robin Meadows is a contributing editor to *ZooGoer*.



Whale-watchers on a commercial tour out of San Diego, California, get a close-up view of a gray whale.

The Real Price of Pollution



EVERYBODY KNOWS THAT POACHING HAS DRIVEN SUCH SPECIES as rhinos, elephants, pandas, and tigers toward extinction. And the loss of wildlife habitats is plain to see as cities spread into the countryside and forests are felled to fuel the growing needs of the urban centers. But a far more insidious problem is the threat posed to many species of plants and animals by pollution. In most cases, the impact of pollution on wildlife is an accident, an unintended effect of chemicals used to benefit humanity. But what are the relative benefits to humanity when wildlife suffers as the result of our actions? And is the impact of pollution on wildlife, like the canary dying in a coal mine, a signal of serious threats to people as well?

Global pesticide sales increased tenfold from 1975 to 1990, and now total \$50 billion U.S. annually. For the farmer, pesticides make good sense because each dollar invested in pesticide returns approximately four dollars in crops saved from the ravages of insects, plant diseases, and weeds.

This is not necessarily to claim great success for pesticides. Agricultural pests still destroy nearly 40 percent of all food and fiber crops in the United States. Further, despite the fact that use of insecticides in the United States has increased tenfold since 1945, crop losses due to insect damage have nearly doubled.

Pesticide use also has some worrying side effects. David Pimentel, a professor of insect ecology and agricultural sciences at Cornell University, estimates that each year in the United States some 672 million birds are exposed to

Story by

Jeffrey A.
McNeely

Illustrations by

Warren Cutler/
NZP

pesticides on the 395 million acres of cropland that receive high pesticide applications. As a result, about 10 percent of these birds die each year.

Following the introduction of new rodenticides, the population of barn owls in the United Kingdom has been reduced by about 10 percent. The owls, which are effective predators on rats, ingest the poison when eating their prey.

In Spain, some 30,000 birds were killed by illegal pesticides used to control crayfish along the boundaries of Cota Donana National Park. Covering 173,000 acres of wetlands, Donana is Europe's richest bird sanctuary, harboring half the continent's flamingos and up to 150,000 geese and wading birds at a time. Ducks, geese, and songbirds from Northern Europe also rest there while migrating to Africa, thus spreading the effects of local pesticide pollution over a far wider area.

Other problems arise long before the pesticides are applied in the field. In 1987, the disastrous fire at the Sandoz chemical works in Basel, Switzerland, leaked as many as 32 pesticides, fungicides, and other agricultural chemicals into the Rhine River, forcing a six-month ban on fishing in its upper reaches. Because nobody planned on such a fire—just as nobody plans on oil tankers hitting reefs or drifting onto rocky shores—little consideration was given to the possible impact of pollution on local ecosystems. By the same token, the risk of accidents such as this are rarely figured into the price we pay for chemicals.



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The Ravages of Acid Rain

Acid rain—caused by sulphur dioxide and other pollutants from coal-fired electric plants, automobile engines, and heavy industry—is another form of pollution that has far-reaching effects on species and ecosystems. It has so affected birds living in the Bunderkamp Forest in the Netherlands, for example, that their eggshells have become too thin to protect the embryos inside. In Scandinavia, seven major salmon fisheries have been destroyed; and in the Czech Republic's Great Bohemian Wood, where 75 percent of the trees have been damaged by acid rain (25 percent fatally), scientists say that 30 percent of fish, 60 percent of amphibians, 30 percent of reptiles, 30 percent of birds, and 35 percent of mammals are threatened.

At the ecosystem level, increasing acidity can reduce populations of lichens, amphibians, and fish, while enabling certain newts, dragonflies, and sphagnum mosses to increase, thereby changing the entire structure of the ecosystem. The producers and consumers of the manufactured goods and energy that ultimately led to increasing acidity surely did not intend these effects.

At a recent meeting, the world's herpetologists discovered a simultaneous and significant decline in populations of amphibians from all parts of the world,

probably due at least in part to increasing acidity. Ten percent of Australia's 194 frog species have suffered significant population declines in the past 10 years. In the Kings Canyon/Sequoia National Park area in California, the mountain yellow-legged frog was found in 38 ponds and streams in 1980, but in only one in 1989. The range of British natterjack toads has been reduced so drastically that they have virtually disappeared from the lowland heaths that formerly supported about half the country's population.

If the worldwide decline of amphibians continues, the productivity of many aquatic ecosystems could be affected. Tadpoles consume large quantities of algae in streams and ponds, frogs and toads are major predators on insects, and amphibians are an important part of the food web for many species.

The study of food webs is still in its infancy, and our ignorance of the ways in which they function and the effects of pollution on them could be dangerous if we knowingly ignore the issue and allow species to disappear before we discover their importance in the functioning of ecosystems. Nobody has meant for the world's frogs and toads to slip away, and it was almost sheer good fortune that the global decline was discovered in time to try to do something about it.

Change in the Weather?

The possibility of climatic change caused by increased levels of carbon dioxide, methane, and other so-called greenhouse gases in the atmosphere has led to a rash of publications, meetings, and intergovernmental negotiations. Only recently have negotiators begun to consider the effects of climatic change on nonhuman species, but the early evidence is very worrying.

Increasing atmospheric carbon dioxide alters the growth rate and reproductive potential of plants, thereby influencing interactions at the community level and beyond. In addition, altered climatic conditions could make life difficult or impossible for major habitat types and species in the locations where they now occur.

Species that are dependent on a narrow range of habitat conditions, such as the giant panda in the bamboo thickets of China or the spotted owl in the old-growth forests of the Pacific Northwest, may be unable to adapt to the fundamental changes in their habitats caused by climatic change. And, even fairly common species such as marmots, which depend on alpine grasslands, would find it more difficult to survive if their habitat were invaded by shrubs and trees.

But rare and endangered species would be especially hard hit. Other factors—especially habitat loss—already threaten nearly

22,000 species with extinction, including about 10 percent of all birds and mammals. These species have been reduced to such low populations and confined to such small areas that extraordinary conservation action is required to save them. The additional stress of climatic change could simply be too much for them.

Some scientists believe that increases in atmospheric carbon dioxide alone, with or without ensuing climatic change, would also affect wildlife populations. Decisions over the past several decades on the use of fossil fuels, which are the primary cause of the carbon dioxide increase, were certainly not made with these potential detrimental effects in mind.

Scientists have provided indisputable evidence that the effects of chlorofluorocarbons (CFCs) on the ozone layer include increased ultraviolet radiation, especially in the temperate regions. In addition to direct effects on people, this could have an incredible impact on the world's plant species. Screenings of more than 200 species of plants showed that, for some 70 percent of them, increases in certain kinds of ultraviolet radiation can decrease photosynthesis, water-use efficiency, leaf area, and yield. Aquatic ecosystems may be even more sensitive. The manufacturers' intent was to provide an effective and nonpolluting refrigerant, propellant, and chemical agent for

making foam. They certainly did not count on subsequent ozone depletion and its far-reaching consequences.

PCBs, Heavy Metals, and Plastics

The population of common seals in the western part of the Waddenze (off the coast of the Netherlands) has collapsed during the past few decades, declining from more than 3,000 to less than 500 animals, due primarily to a sharp decline in pup production. The Waddenze receives a full load of pollutants washed down the Rhine River from the industrial and agricultural heartland of Europe.

A detailed study by Dutch scientists identified the culprit: Seal reproduction is being disrupted by a complex and highly toxic family of chemicals known as polychlorinated biphenyls (PCBs). The PCBs are concentrated in fish that feed in the highly polluted waters of the Waddenze, and they become further concentrated in the seals that eat the fish. The farmers and manufacturers of the Rhine Basin surely did not foresee these consequences—and the fishermen of the Waddenze may not realize that the fish they catch could be a health hazard to humans.

The impact of heavy metals on wildlife populations is poorly known, but in 1979, whale meat offered for sale in Japanese grocery stores was reported to contain mercury levels of 2.3 parts per

million, six times the level the Japanese government considers acceptable for human consumption. Similarly, certain gold mining techniques have led to a level of mercury pollution in the Amazon that is beginning to affect fish populations. The producers of the pollutants were unlikely to realize that whales and fish would accumulate their by-products, and the consequences of people eating chemical-laden seafood are often so subtle and long-term that these costs are not considered in the price consumers pay for fish.

Even seemingly innocuous plastics have had severe impact on wildlife populations. Along portions of the industrialized coast of Great Britain, concentrations of raw plastic particles have reached densities of 57,000 pieces per cubic yard in sea-bottom sediments. Of the world's 280 species of seabirds, about 15 percent are known to ingest plastic, as are four of the seven species of marine turtles. Plastics have also been found in the stomachs of pygmy sperm whales, rough-toothed dolphins, Cuvier's beaked whales, and West Indian manatees. Neither the producers nor the consumers of plastics were likely to know the real price of this material.

A More Realistic Cost Assessment

Pollution in its many forms has had profound effects both on the health of individuals and the structure of ecosystems,



The population of common seals in the western part of the Waddenze has collapsed during the past few decades, due primarily to a sharp decline in pup production. The Waddenze receives a full load of pollutants washed down the Rhine River from the industrial and agricultural heartland of Europe.



But we can't just blame the fat-cat industrialists for the problem. In fact, because pollution costs are not included in the prices we pay for goods we buy from polluting industries, for driving our cars, or for food we purchase at the grocery store, we, as consumers, are also getting a free ride.

selecting against those forms that are most sensitive to chemical changes. The benefits of the many manmade chemicals on which we've come to depend are relatively easy to quantify, and many of these benefits—control of diseases and pests, cheap and convenient transportation, ample food supplies—are widely appreciated.

However, the real costs of chemicals and other manufactured goods have often been neglected because they are far more difficult to quantify. It has been easy to hide these costs because wild nature benefits everybody—now and in the future—with individuals being charged for these benefits (or even realizing that they are benefiting).

Pollution, overexploitation, and other abuses have been all too common, at least partly because most of us have considered wildlife, waterways, the atmosphere, grazing lands, and forests to be limitless or free. Such abuse is often in

the interest of individuals seeking to line their own pockets. After all, the less money spent on controlling the pollution produced by a car or an industrial plant, the higher the profits for the seller.

But we can't just blame the fat-cat industrialists for the problem. In fact, because pollution costs are not included in the prices we pay for goods we buy from polluting industries, for driving our cars, or for food we purchase at the grocery store, we, as consumers, are also getting a free ride. Pollution and overexploitation keep prices down, which we like. And it's easy to ignore the fact that these prices are artificially low because we don't pay the full costs.

Only when the costs intrude on our consciousness—when another oil tanker runs aground, when a species disappears forever, when cancers appear in children living near hazardous waste disposal sites, when another highway is closed by

a toxic chemical spill—are we likely to react. And, at that point, corrective action is usually far more expensive than preventive action would have been decades earlier.

This is our tragedy: The loss of species and habitats is a symptom of how severely we have abused our planet. And this has happened partly because we have blissfully ignored the negative impacts of our consumption. We have harvested the benefits while remaining oblivious to the costs, more often through ignorance and inadvertence than through malignant intent. But, now that we are beginning to realize the impact of our consumer lifestyles on the living systems of the planet, can we and will we do anything about it? ♣

Jeffrey A. McNeely is Chief Conservation Officer at the International Union for Conservation of Nature and Natural Resources in Switzerland.

A Tree Fit for a Queen

Some years ago, after a trip to Egypt, a vision of jacaranda trees clothed in lavender-colored blossoms against a backdrop of the Giza pyramids remained in my mind as a memento of that ancient land. Several weeks after returning to Washington, then awash in the blooms of spring, I was amazed to see what I thought was a jacaranda growing practically in my own backyard—on the Zoo's grounds in a fenced-off area in the blesbok yard.

The tall, ivy-clad tree was covered with wisterialike clusters of blossoms. The leaves had not yet appeared and the lavender shades of the blooms contrasted with the deep blue of the spring sky. The ground beneath was blanketed with its fallen flowers—trumpetlike blossoms tinged buttery yellow inside.

It seemed odd that a tree able to survive Egypt's arid heat could successfully emigrate and establish itself in Washington's temperate climate. As it turned out, the tree in question was definitely not a jacaranda with African and Middle Eastern connections, but a paulownia, rooted in the civilizations of China and Japan.

And the tree in the blesbok yard was not a lonely specimen. Other paulownias

were growing in what is now the tapir yard at the Zoo's Connecticut Avenue entrance, near the giant kingfisher's yard at the Bird House, and on the hillside descending toward Rock Creek bordering on Parking Lot A. They were also growing in Rock Creek Park—several are easily spotted when they are in bloom, usually in May, from the bridges that cross the Park near the intersection of Connecticut Avenue and Calvert Street.

It appeared that these trees grow prolifically throughout the region. And, not only are there a lot of them, they have a long history that weaves through Asia, Europe, and North America.

A Chinese encyclopedia of natural and cultural objects, the *Erh-ya*, contains the earliest written record of the paulownia. The encyclopedia, usually attributed to Chou Kung, duke of Chou and the son of the first ruler of the Chou Dynasty, appeared around 1000 B.C. It is the only known record of the prehistoric Chinese lore of natural history. The encyclopedia contains a reference that praises the beauty and utility of the "glorious paulownia wood."

According to Chinese legend, the tree was an omen of good fortune because of its

association with the phoenix, a mythical bird that regenerated itself in fire. The phoenix must have been as picky as a pampered cat of today, because it would alight in only the very choicest of paulownia trees and appear only when a benevolent ruler was in power. The paulownia thus was cultivated extensively to encourage the appearance of the phoenix.

In China, uncultivated paulownias grow only in very remote temperate regions, primarily in open, marginal areas of forests, where they share habitat with such "living fossil" trees as the ginkgo and metasequoia (which can be

seen in the Zoo's Beaver Valley). In the past, these regions were also home to isolated communities of Taoist and Buddhist monks, whose members were well-versed in the natural history of their surroundings.

Centuries ago, a monk carved a fish from the wood of a paulownia. The carving, which produced a deep, thunderlike sound when struck with a stick, was hung just inside a temple gate and used as a bell. Today, a fish-shaped paulownia bell still is used in many Buddhist monasteries to summon the monks.

The paulownia has continued to hold special meaning for the Chinese even into re-



Paulownia blossoms. (Marilyn Wood, Photo/Nats)

cent times. Before Mao Tse-tung came to power, Chinese intellectuals gathered for companionship in groves of paulownias. An educated Chinese aspired to become *chun-tzu*, a man of complete virtue. Because the living paulownia has soft, brittle wood that becomes hard and strong after it is cut, the Chinese considered the tree to have a tender heart and steady character, the very essence of *chun-tzu*.



Area paulownias generally bloom in May. (Virginia Twinam-Smith, Photo/Nats)

Today, the tree's bark, wood, flowers, fruits, and leaves still are used in traditional Chinese medicine to promote growth of hair, darken graying hair, reduce swelling in the feet, heal bruises, and treat patients suffering from hallucinations and delirium.

From China, the paulownia was introduced to Japan, where it became an important part of another ancient culture. A manuscript dating to

1049 A.D. notes that paulownia wood readily survives repeated drying and soaking, and lasts longer than pine, fir, or oak. These qualities made it suitable for use as beams and pillars in houses and for making coffins. The wood found its way into a number of other objects as well: *geta*, or wooden clogs, furniture, ornamental carvings, wooden bowls and spoons, bas-relief panels, and, because the wood is so resonant, the *koto*, a long zitherlike musical instrument with 13 silk strings.

The paulownia became so revered in Japan that its leaves and flowers were incorporated into the Order of the Paulownia Sun, established in 1888 by Emperor Meiji. The honor is bestowed on those who have demonstrated outstanding civil or military merit. Generally awarded to high-ranking diplomats, generals, and admirals, and the highest honor Japan can bestow on a foreigner, it was presented to General Douglas MacArthur in 1960.

Perhaps the best example of Japanese respect for the paulownia, however, is the tree's link to the ritual of marriage. On the occasion of the birth of a daughter, the father would plant a paulownia. The tree grows quickly—as much as 16 feet a year—and by the end of a

decade can reach a height of 40 feet. When the daughter was betrothed, the paulownia was felled and the lumber used to make a *tansu*, or dowry chest. The tradition thrived until the 1970s, when a blight wiped out the Japanese paulownias.

In 1972, a Japanese walnut-log buyer happened to find what looked like paulownia growing along Virginia's Skyline Drive. He took samples of the wood, flowers, and leaves back to Japan for analysis and discovered that the American tree was just as good as Japanese paulownias. A lucrative new export industry sprang up overnight. High-quality lumber from a single mature tree can bring as much as \$20,000 from Japanese customers.

In West Virginia, where the tree thrives on land reclaimed from strip mining, the nonprofit Panhandle Paulownia Club, Ltd., leases land at a rate of one dollar per acre per year to families who commit to planting and caring for paulownias. Profits from sales of mature trees go toward education for the children of these families.

Unfortunately, the trees have also attracted the attention of "paulownia poachers," who cut mature specimens in an attempt to earn easy mon-

ey. As recently as February, several trees mysteriously disappeared in the Washington area. However, wild-growing trees are rarely of high-enough quality for export. The Zoo's paulownias, for example, are all uncultivated and unsuitable for commercial use.

Westerners first learned about the paulownia when Swedish botanist Karl P. Thunberg documented it on a visit to Japan in the 1770s. It was named in honor of Anna Paulovna, the granddaughter of Catherine the Great and wife of Willem II, king of the Netherlands from 1840 to 1849. From its association with her, the paulownia also gets its popular name, the princess, or empress, tree.

By the 1830s, the porcelain trade brought regular contact between Asia and the United States, which was probably how the paulownia spread to this continent. In the days before packing "peanuts" and plastic sheets of air bubbles, paulownia seed pods served as packing material for shipments of delicate porcelain to the United States. When the pods were discarded, the trees sprouted throughout the East, especially along the banks of the Hudson, Schuylkill, and Brandywine Rivers.

These introduced trees were popular exotics in their early

years and were written about in horticultural and botanical magazines of the time. A brisk trade in paulownia seedlings soon developed. However, by 1847, people had learned that the tree could be propagated by root cuttings as well, and the demand for seedlings dropped precipitously. Although the paulownia became widespread along the East Coast within 20 years of its arrival, its messy seed pods and lack of color in the fall discouraged horticulturalists from using it more frequently in cultivated garden settings.

Today the paulownia is found mostly as a wild-growing tree throughout the mid-Atlantic and southeastern United States, often along state and federal highways in the first decade after construction. When not in bloom, the paulownia is easily recognized during the summer by the enormous size of its leaves, which provide deep shade even on the brightest days.

By fall, after the leaves drop, the large seed pods make the tree readily identifiable. The pods break open and release their winged seeds, which are carried by the breeze to nearby locations where they germinate. A single pod contains as many as 1,500 seeds, and a large tree can produce 20,000,000 seeds—more



Paulownia tree in bloom. (Philip Beaurline, Photo/Nats)

than 14 pounds—each year. The dried pods remain on the tree throughout the winter. The rustling sound of wind blowing through the pods gives the paulownia another of its common names, the rattlebox tree.

Biologist Peter Beckjord believes that, in the United States and in developing countries where land has been damaged by poor agricultural and industrial practices, paulownia trees may be an ideal solution for land reclamation. Because the paulownia regenerates quickly from roots, it is able to survive fires (perhaps one of the reasons it was associated with the phoenix) and thrive in marginal conditions.

And, according to Beckjord, the species paves the way for, rather than com-

petes with, successive growth of other, more desirable trees. By the time a paulownia reaches the flowering stage—after eight to ten years—other trees and shrubs have had a chance to become established in the area. Paulownia seeds cannot penetrate the debris on the forest floor to sprout and take root, allowing other species to take over.

And what of the lovely Egyptian jacaranda trees, so evocative of pharaohs and pyramids, that provided the inspiration for my "paulownia odyssey"? Turns out they are distant relatives of the paulownia, but they are not African or Middle Eastern natives: Jacarandas are indigenous to the dry, tropical regions of the Americas!

—Margie Gibson

Sunset Serenades

Sunset Serenades/93, Washington's favorite free summer concert series, will be held on six consecutive Thursday evenings, from 6:30 to 8:00 p.m., on the new stage at Lion/Tiger Hill.

- Trux Baldwin & The Starlite Octette kick off the series July 1, with an evening of music from the Big Band era. The group will be joined by the high-spirited and high-stepping Catholic University Dance Team.

- On July 8, Ban Caribe will delight the crowd with its unique combination of soulful singing and salsa rhythms.

- The July 15 concert features the distinctive pop rock stylings of Essentials.

- Perennial favorite Mariachi de las Americas returns with its south-of-the-border sound July 22.

- On July 29, another Sunset Serenades veteran, John Lyon & The Gross National Product, will provide an evening of foot-tapping American folk music along with John Lyon's original tunes. The evening will also include a performance by the Tisza Ensemble, whose violins and swirling dancers evoke visions of Hungarian folklife.

- The series winds up August 5, with an evening of jazz from the Keter Betts Quartet.

This year, for the first time, each concert will feature a "meet an animal" (and its keeper) demonstration during intermission. Keeper and animal will remain on hand after the demonstration so children can get a closer look.

Performances will be canceled only in the event of rain

at the beginning of, or during, the show. You may reserve a FONZ picnic basket by calling Food Service at 202.673.4978 at least 24 hours before the concert. Refreshments will also be available at the Mane Restaurant. For more concert information, call 202.673.4717.

Recent Births

Monday, April 19, was a banner day at the National Zoo, with the births of a pygmy hippopotamus and six red wolf cubs. Weighing only 11 pounds at birth, the female pygmy hippo is a mere shadow of her future self: she will probably be at least 40 times heavier as an adult.

The pygmy hippo is native to West Africa, with the majority of animals living in Liberia and the Ivory Coast. Unlike its larger hippo relative, which occupies grassland habitat, the pygmy hippo lives in forested areas. Pygmy hippos are threatened in the wild, where they are hunted as a food source.

The Zoo's new pygmy hippo is the sixth calf born to Epsilon, her 29-year-old mother. The calf's father, Timmy, was born in the wild in Liberia, probably in 1966. The National Zoo's program for breeding pygmy hippos has been extremely successful—the new calf is the 58th born at the Zoo.

Two of the six red wolf cubs born April 19 were stillborn, but the other four—three females and a male—are doing fine and can be seen in their Beaver Valley enclosure.

Native to the southeastern United States, the red wolf



Epsilon and her new calf. (Jessie Cohen/NZP)

had become so rare by the mid-1970s that the U.S. Fish & Wildlife Service decided to remove the remaining animals from the wild for an ambitious zoo breeding program. Today, zoo-born red wolves—including the National Zoo's latest litter—are being reintroduced into wild sites, including Great Smoky Mountains National Park.

And, last but certainly not least, the sloth bear cubs born in January have now emerged from the cubbing den. The appearance of two cubs came as a pleasant surprise to keepers, who had only heard one animal while mother and cubs remained in the seclusion of their den.

Giant Panda Conservation Action Plan

At an April 20 news conference in the Zoo's Education Building Auditorium, American Association of Zoological Parks and Aquariums (AAZPA) Executive Director Sydney Butler announced the organization's new Giant Panda Conservation Action Plan.

In his remarks, Butler stressed that the new pro-

gram is "first and foremost, a conservation plan and not an exhibition plan. Its ultimate goal is to maintain a self-sustaining population of giant pandas in nature."

The plan provides for a unified North American zoological community to harness its collective fundraising, scientific, and educational resources for conservation of the severely endangered giant panda. The AAZPA will also institute a new giant panda Species Survival Plan (SSP), providing for centralized management of giant panda initiatives by North American zoos.

The plan includes establishment of an operational fund to support a full-time plan coordinator, provide expenses for a negotiator and other technical experts, and seek ways to enhance existing habitat protection and antipoaching efforts. Finally, the plan calls for institution of an accountability structure to ensure that any funds from North American zoos go to the projects most necessary for giant panda conservation in China.

The Area Scene

White-tailed deer give birth and nurse their young in June. Also, the young of many small mammals venture forth in search of food with their parents for the first time during June and July. Raccoons, opossums, and foxes all eat the fleshy fruits of the season: mulberries in late May and early June, and wild blackberries and raspberries in June and July.

Indian pipes are in bloom in the area from mid-June to late July. These strangely beautiful, ghostly white plants (other common names include ice-plant, ghost-flower, and corpse-plant), whose blooms generally droop groundward, can be found growing in moist areas and wooded slopes. American Indians used the plant's juice as a tea for aches and pains and as a remedy for bunions and warts. Watery extracts are in fact bactericidal. However, botanists warn that the plant's toxic properties are not fully understood.

The Bad News...

Construction of Hong Kong's new airport on reclaimed land will require dredging of more than 520 million cubic yards of marine sand. The project is so monumental that three-quarters of the world's dredgers are involved in the work. Where dredging has already started—in a group of islands called the Ninepins in the southeastern waters of Hong Kong—seabed life has been destroyed as well as the fringe of corals. The Hong Kong government has named several new dredging areas

where the impact is bound to be equally devastating to marine life.

From Oryx, April 1993.

...The Good News

The human population explosion is one of the greatest threats to the preservation of biodiversity. In developing countries in particular, natural habitats are being converted to cropland or pasture to meet human needs, with a consequent loss of wildlife. But a recent analysis of population trends in 44 developing countries shows a drop in average family size from six in the 1960s to four today, primarily as a result of increasing use of modern family planning methods. Such countries as Indonesia, Peru, and Thailand—all important centers of biodiversity—have made particularly impressive strides in reducing fertility.

From New Scientist, March 13, 1993.

What's In a Name?

The sloth bear's slow, shambling gait would seem the obvious explanation for its common name, but the real reason lies in the taxonomic debate over the animal's scientific name. When George Shaw published the first valid description of the sloth bear in 1791, he named it *Bradypus ursinus*, *Bradypus* being the generic name for the three-toed sloth of Central and South America. Based on the animal's dentition, Shaw believed that it was in fact a sloth.

Shaw wasn't the first person to confuse the sloth bear with the sloths proper. An

earlier naturalist, describing a light-colored animal with no tail and "a head like that of a dog," observed that this creature (which he called *Tardigradus*, *Ceilonicus*, the sloth from Ceylon) was "very different from the American sloth." Modern taxonomists believe this naturalist was either the victim of a seafarer's practical joke or his own poor judgment when receiving various parts of a sloth bear and a three-toed sloth.

Perhaps because of the animal's lackadaisical locomotion, "sloth bear" stuck as a common name. The sloth bear's scientific name is *Melursus ursinus* (honey bear), which refers to its habit of tearing into bee nests for the sweet food within.

A "Palletable" Solution

Disposable wooden pallets, used throughout the storage and shipping industries as platforms for bulky items transported by forklift, are yet another cause of forest destruction, and, according to some estimates, account for

one-fifth of landfill waste. To help rectify the situation, Chep, USA, has developed a more durable, reusable pallet. The company rents the pallets to the grocery industry, which can return damaged pallets for repair. In three years, Chep, USA, has been able to capture a significant share of the U.S. pallet market in its bid to consign the disposable pallet to the scrap heap of history.

Urban Animal Safari

The Washington metropolitan area provides ideal habitat for a variety of wild animal artistic creations. These lively, if inanimate, creatures range all over the region, from our most famous public places to the most secluded private lairs. Pictured here is one of these fantastic animals—do you know where to spot it? (Look for the answer in our July/August issue.)

Answer to the March/April Urban Animal Safari: Apartment building, 2812 Connecticut Avenue, N.W., Washington, D.C.



(Christy Bowe)

The Gray Whales of Ojo de Liebre

Right around dawn, they came close to the beach. The fog made it impossible to see anything, but I could hear a wet huffing when they breached, followed by the patter of droplets from their spouts and a heavy sloshing as they dived back below the surface. I had my camera ready and stood waiting as the sun rose, fat and red, drying the cool morning air.

In the next few minutes, the landscape emerged. Just to the west, several small boats called *pongás* stood leaning in the muddy sand, slowly rising off their keels as the tide came in. To the east, the beach gave way to marsh. Tiny birds with thin, curved beaks hopped about, pecking at the sea grass. The marsh curved away from sight and the coastline reappeared farther on as the gray hills of the Vizcaino Desert.

Still holding my camera, I waited for a chance to shoot the gray whales. But, by the time the fog evaporated they had returned to the middle of the lagoon, following the mysterious instincts that govern their lives. Only the lapping water broke the quiet of the near-deserted beach.

Laguna Ojo de Liebre (also known as Scammon's Lagoon) serves as a winter home for *Eschrichtius robustus*, and may be the largest and most significant of the gray whale breeding lagoons. Each autumn, the whales migrate 6,000 miles from their summer home in the Arctic waters of the northern Bering and southern Chukchi Seas to breed, give birth, and nurse their young in these warm, shallow waters halfway up the western side of Mexico's Baja California peninsula.



A lighthouse on Laguna Guerrero Negro, just a few miles north of Laguna Ojo de Liebre. (Maurice Martin)

My trip through Baja to Ojo de Liebre began in Tijuana, just across the border from San Diego, California. There, I picked up Mexican Route 1, which runs the length of the peninsula. The 440-mile drive southward through this rocky, sparsely populated frontier attests to the past dangers of travel in Baja: Rusted-out cars litter the desert, the victims of poorly paved roads, treacherous turns on rocky hillsides, and desert heat. But, recent road improvements have made the rugged countryside more accessible to the casual visitor.

Laguna Ojo de Liebre lies just south of where Baja California Norte turns into Baja California Sur. A few miles past the giant metal eagle that marks the boundary between these Mexican states, I picked up a road running westward from Route 1. A sign marked it as the road to the *Parque Natural de la Ballena Gris* (Park of the Gray Whale), which includes Laguna Ojo de Liebre. Washboard ridges and deep potholes made this road the roughest part of the trip.

Along the way, I passed flat, wet areas surrounded by little earthen levees. Workers from the nearby town of Guerrero Negro channel seawater into these *salinas*, where it dries in the desert sun. The salt left behind provides Guerrero Negro with its livelihood; an enormous salt

exporting company employs most of the town. Because the salt comes from seawater and must be clean and free of pollutants, industry and wildlife preservation share a common interest in this area.

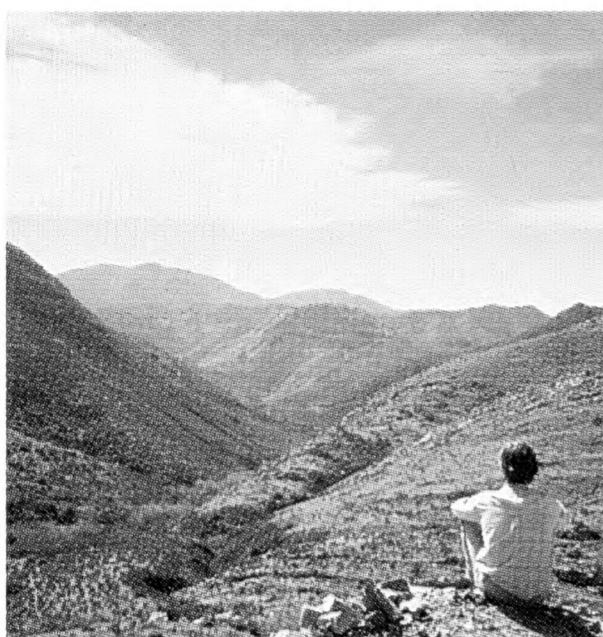
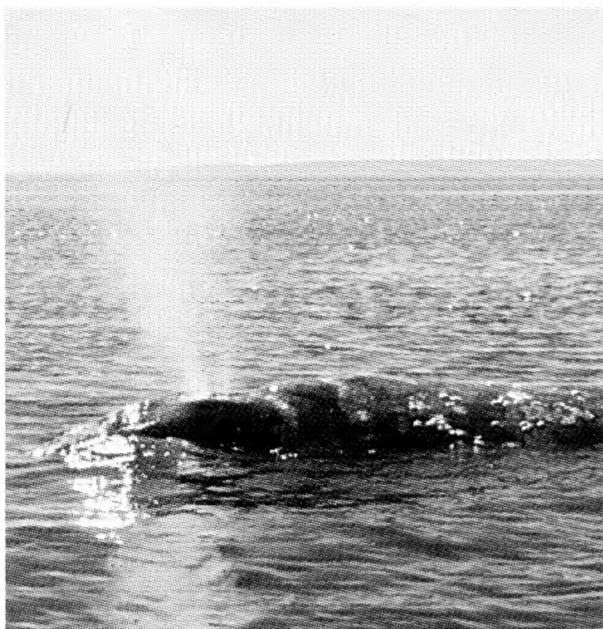
The road to Ojo de Liebre ends at an isolated beach, where I camped overnight hoping for a chance to photograph the gray whales. The fog hid the whales during the first hour after dawn, but I knew there would be another chance later in the morning.

At about eight o'clock, several pickup trucks arrived on the beach. The men who clambered out were members of the Ejido Benito Juarez—the commune whose people act as caretakers of the park—and they began loading their *pongás* with life jackets, paddles, and outboard motors.

Would-be whale-watchers gathered nearby—most were American tourists who drove the transpeninsular highway, heading for such vacation spots as Mulege and Cabo San Lucas. A side trip to Laguna Ojo de Liebre provided them with a much-needed break from the long expanses of desert.

I paid the Ejido men \$10 and stepped aboard a *ponga*. Luckily, my boat had only four other passengers, giving me more room to position myself to take pictures as the boat roared out into the lagoon.

What looked like black humps from the shore took



Clockwise from bottom left: The arid, cool hills of Baja California Norte encourage contemplation; a gray whale spouting—up close, the sound is like that of a wet tuba; Mexican Route 1, something of an adventure in itself, takes the traveler past beautiful, secluded stretches of Baja California's Pacific coast. (Maurice Martin)

on character up close: The whales have mottled gray and black skin, and as they arched up out of the water, I saw their backs, full of bony ridges like a sea serpent. Occasionally, one flashed a thick fin or a Y-shaped tail, or exhaled, sending moist air out of its blowhole and groaning like a wet tuba.

The speed of the gray whales startled us. The Ejido men maneuvered parallel to one that paced the boat at a brisk clip for a while, surfacing occasionally to our right. Suddenly, the whale changed course and we saw a huge, dark shape moving our way.

Through the clear water we saw the whale passing

underneath, and for a moment I wondered what would happen if it decided to pop up right under our boat. But, the behemoth zipped away to the left, leaving us to breathe a little easier.

Occasionally we saw pairs of whales either swimming side by side or drifting on the surface. The boatmen explained that these were mother-and-calf pairs and that they sometimes drift on the surface while sleeping or nursing. At one point, the pilot spotted such a pair and maneuvered so that we were upwind of them.

He then cut the engine and we drifted toward them, gently nudged by the breeze. As we got closer and closer,

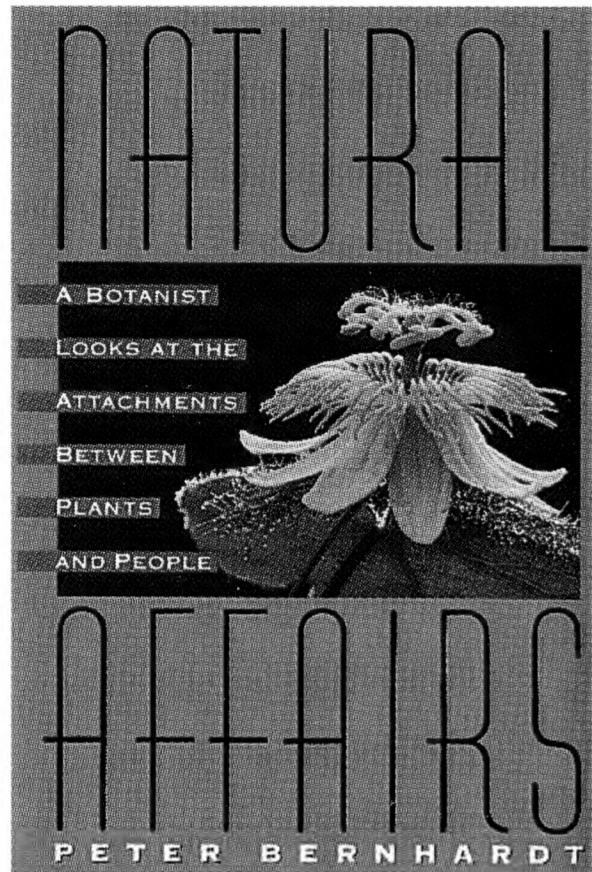
a hush fell over the boat, broken only by the clicking of camera shutters. I wondered how close we would get before the whales woke up and dived beneath the surface. Surely they will go at any moment, I thought, as I hurriedly snapped picture after picture.

Suddenly, I ran out of film. We continued to drift near the whales, who were almost within arm's length now, their great backs glistening in the harsh Baja sun, their blowholes dilating with their steady, calm breath. Finally, we were just a few feet away when the mother whale turned, arched her body, and, with a flick of

her tail, disappeared into the blue water, her baby right behind her.

As the pilot turned the boat back toward shore, I remembered that gray whales were called devilfish in the old whaling days because of the ferocity with which they fought when harpooned. It is an inappropriate name for such a tolerant and apparently gentle creature, that, when a boatload of people approached her offspring, merely swam away.

Maurice Martin is a freelance writer living in Arlington, Virginia. His article on Kodiak Island, Alaska, appeared in the January/February 1992 *ZooGoer*.



Natural Affairs:
A Botanist Looks at the
Attachments Between
Plants and People.

1993. Peter Bernhardt.
Villard Books, New York.
225 pp. hardbound,
\$25.00.

Consider the rather generous salad botanist Peter Bernhardt tosses for dinner: Its ingredients come from eight different plants belonging to seven different plant families with origins in five different parts of the world. The edible parts of the plants that make up the salad are also diverse: the leaf blade of lettuce, the leaf stalk of celery, the leaves and bulb (actually an underground stem) of scallions, and the taproot of radishes.

Tomatoes and cucumbers, of course, are fruits, but only tomatoes are eaten ripe, in the botanical sense of being ready to release sproutable seeds. A ripe cucumber would be mushy inside—not to mention bitter and cramp-inducing—and a mottled yellow outside, resembling its gourd cousins. Artichokes and capers are flowers, the former being a young flower head and the latter a flower bud(!).

The charm of *Natural Affairs* stems, in part, from such revelations about plants (and our relationship to them) that are so familiar that we generally fail to think about them. Capers, for instance, are an item whose provenance it never even occurred to me to question, although knowing they are the flower buds of a species of clammy weed native to the Mediterranean doesn't enhance their appeal. Saffron, a costly but essential

ingredient in paella and bouillabaisse, is the dried stigma (female sex organ) of a single species of autumn-flowering crocus. This crocus bears but three slender stigmas per flower, and about 4,000 stigmas must be hand-harvested to make up an ounce of the powder, which once was worth more than its weight in gold.

Whether about the familiar or not, however, the tales Bernhardt weaves about plants and flowers and people are both amusing and enlightening. And his references are encyclopedic, as he draws on history, mythology, art, and literature as well as horticulture, agriculture, and botanical science. He even throws in a few recipes for good measure.

The author traces how columbines came to symbolize infidelity in Victorian England, when earlier the flowers had represented humility and even Christianity's Holy Spirit. In another chapter, he summarizes scientific debate on the taxonomy of *Cannabis*, and recounts the debate's legal ramifications for marijuana users. And, in another, featuring a Robert Mapplethorpe photograph of an orchid, he describes this flower's devious way of attracting pollinators, then wonders whether the reproductive machinations of some orchids don't surpass in kinkiness anything seen in

Mapplethorpe's notorious photographs of people!

But Bernhardt does more than regale the reader with ethnobotanical trivia. In each of the 14 essays in *Natural Affairs*, the author offers effortless and wide-ranging instruction in botany. We learn why magnolias and other trees from the southeastern United States are more similar to species from southern China than to those of the western U.S. (It has to do with Pleistocene glaciation and bird migration routes.) We learn why orchid flowers last a month, while most passion-fruit flowers are spent in 12 hours. And we learn about dozens of the ingenious ways that plants evolved to lure animal pollinators—and to avoid or repel animal "predators."

In *Natural Affairs*, plants come to life, even—or especially—for people most interested in animals. It is a book about what plants do, why they do it, and who they do it with. Read a few chapters sitting in your garden. You might find yourself looking at that bed of columbines or the potted primrose in a whole new way.

—Susan Lumpkin

Natural Affairs is available in the Zoo Bookstore, located in the Education Building at the National Zoo. For mail orders, please call 202.673.4967.



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